CLAIMS

1. A recombinant attenuated coxsackievirus B4 virion which is engineered to contain a heterologous nucleic acid within the open reading frame of its genome, wherein the heterologous nucleic acid encodes a heterologous polypeptide which is expressed by the virion.

2. The recombinant attenuated coxsackievirus B4 virion of Claim 1 which is JVB.

3. The recombinant attenuated coxsackievirus B4 virion of Claim 1 which is CB4-P.

4. The recombinant CB4-P virion of Claim 3 wherein the heterologous nucleic acid is in the P1 region of the genome.

5. The recombinant CB4-P virion of Claim 4 wherein the heterologous nucleic acid is in frame with the coding region such that the heterologous polypeptide is expressed as a fusion of a viral capsid protein.

6. The recombinant CB4-P virion of Claim 5 wherein the heterologous polypeptide is expressed within an immunogenic region of the viral capsid protein.

7. The recombinant CB4-P virion of Claim 6 wherein the heterologous nucleic acid is expressed as an internal fusion of VP1.

8. The recombinant CB4-P virion of Claim 6 wherein the viral capsid protein is VP1.

9. The recombinant CB4-P virion of Claim 6 wherein the immunogenic region of VP1 contains B-cell epitopes, T-cell epitopes, or both.

Sub. a1

10. The recombinant CB4-P virion of Claim 8 wherein the heterologous polypeptide is expressed within the viral capsid protein VP1 at a position which corresponds to the DE loop.

11. The recombinant CB4-P virion of Claim 10 wherein the heterologous nucleic acid is directly downstream of codon 129 of VP1 coding sequences.

12. The recombinant CB4-P virion of Claim 11 wherein the heterologous nucleic acid replaces nucleic acid sequences corresponding to VP1 codons 130-137 of wild type CB4-P.

13. The recombinant CB4-P virion of Claim 4 wherein the heterologous nucleic acid is inserted in frame and directly upstream of sequences which encode VP4.

14. The recombinant CB4-P virion of Claim 13 wherein the heterologous polypeptide is expressed as an amino-terminal fusion of the viral polyprotein.

15. The recombinant CB4-P virion of Claim 14 wherein the amino-terminal fusion is susceptible to cleavage from the viral polyprotein by a viral protease.

16. The recombinant CB4-P virion of Claim 13 wherein the heterologous nucleic acid is inserted directly after the first codon of the viral polyprotein.

17. The recombinant CB4-P virion of Claim 14 wherein the insert is from about 60 nt to about 360 nt.

18. A nucleic acid comprising the complete genome of a recombinant attenuated coxsackievirus B4 virion which is engineered to contain a heterologous nucleic acid within the open reading frame of its genome, wherein the heterologous nucleic acid encodes a heterologous polypeptide which is expressed by the virion.

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19. The nucleic acid of Claim 18 wherein the attenuated coxsackievirus is JVB.

20. The nucleic acid of Claim 18 wherein the attenuated coxsackievirus is CB4-P.

21. The nucleic acid of Claim 20 which is an infectious cDNA of the CB4-P genome.

22. The nucleic acid of Claim 20 which is an infectious RNA of the CB4-P genome.

23. The nucleic acid of Claim 20 wherein the heterologous nucleic acid is inserted into the P1 region of the genome.

24. The nucleic acid of Claim 23 wherein the heterologous nucleic acid is inserted into the coding region of VP1.

25. The nucleic acid of Claim 24 wherein the heterologous nucleic acid is inserted into sequences which encode the DE loop of VP1.

26. The nucleic acid of Claim 25 wherein the heterologous nucleic acid is directly downstream of codon 129 of VP1 coding sequences.

27. The nucleic acid of Claim 26 wherein the heterologous nucleic acid replaces codons 130-137 of VP1 coding sequences.

28. The nucleic acid of Claim 20 wherein the heterologous nucleic acid is inserted in frame and directly upstream of sequences which encode VP4.

29. The nucleic acid of Claim 28 wherein the heterologous nucleic acid is inserted directly after the first codon encoding VP4.

30. The nucleic acid of Claim 26 wherein the heterologous nucleic acid is from about 25 nucleotides to about 39 nucleotides in length.

31. The nucleic acid of Claim 26 wherein the insert is antigenic when expressed in the context of the CB4-P genome.

32. The nucleic acid of Claim 31 wherein the insert further encodes a T cell epitope, a B cell epitope, or both a T cell and a B cell epitope.

33. The nucleic acid of Claim 31 wherein the insert encodes an viral polypeptide or a fragment thereof.

34. The nucleic acid of Claim 31 wherein the insert encodes an bacterial pathogen polypeptide or a fragment thereof.

35. The nucleic acid of Claim 31 wherein the insert encodes an HIV polypeptide or a fragment thereof.

36. The nucleic acid of Claim 35 wherein the insert encodes HIV p24 or a fragment thereof.

37. A method for inducing an immune response to a polypeptide in an individual, comprising:
   a) providing a recombinant attenuated coxsackievirus B4 virion which is engineered to contain a heterologous nucleic acid within the open reading frame of its genome, wherein the heterologous nucleic acid encodes a heterologous polypeptide which is expressed by the virion; and
   b) administering the recombinant attenuated coxsackievirus B4 virion to the individual under conditions appropriate for infection.

38. The method of Claim 37 wherein the recombinant attenuated coxsackievirus B4 virion is formulated with a physiologically acceptable carrier.

39. The method of Claim 37 wherein the heterologous nucleic acid is expressed in the recombinant attenuated coxsackievirus B4 virion as an internal fusion of VP1 such that the heterologous nucleic acid is expressed within an immunogenic region of VP1.

40. The method of Claim 37 wherein the immune response comprises the generation of a cytotoxic T-cell response, a T helper cell response, B cell response, or any combination thereof.

41. The method of Claim 37 wherein the heterologous nucleic acid is expressed as an amino-terminal fusion of the viral polyprotein.

42. The method of Claim 41 wherein the amino-terminal fusion is susceptible to cleavage from the viral polyprotein by a viral protease.

43. The method of Claim 37 wherein the heterologous nucleic acid further encodes a T-cell epitope.

44. The method of Claim 37 wherein the polypeptide is a polypeptide or fragment thereof from a pathogen of the individual.

45. The method of Claim 44 wherein the immune response which is generated in the individual is prevents or inhibits disease progression in the individual.

46. The method of Claim 37 wherein the polypeptide is a viral polypeptide.

47. The method of Claim 46 wherein the viral polypeptide is an HIV polypeptide.

48. The method of Claim 47 wherein the HIV polypeptide is p24 or a fragment thereof.

49. The method of Claim 37 wherein the individual is human.

50. The method of Claim 37 wherein the individual is an animal.

51. The method of Claim 37 wherein the individual is immunocompromised.

52. A method for inducing an immune response in an individual which is protective against coxsackievirus B4, comprising:

a) providing a CB4-P virion; and

b) administering the CB4-P virion to the individual under conditions appropriate for infection.

53. A method for delivering a polypeptide to an individual, comprising:

a) A recombinant attenuated coxsackievirus B4 virion which is engineered to contain a heterologous nucleic acid within the open reading frame of its genome, wherein the heterologous nucleic acid encodes a heterologous polypeptide which is expressed by the virion, wherein the heterologous nucleic acid is expressed as an amino-terminal fusion of viral polyprotein wherein the amino-terminal fusion is susceptible to cleavage from the viral polyprotein by a viral protease; and

b) administering the recombinant attenuated coxsackievirus B4 virion of step a) to the individual under conditions appropriate for infection.